

Claims

What is claimed is:

(1) An antenna apparatus, comprising:

a rod-shaped antenna element;

a feeding part to feed electronic signals to, and receive electronic signals from, said antenna element;

a first ground plane near said antenna element and oriented approximately parallel to said antenna element so as to serve as a background to at least one direction in which said antenna element radiates electromagnetic waves, and;

a second ground plane near said antenna element and oriented approximately parallel to said antenna element and in a different direction from said first ground plane.

(2) The antenna apparatus according to Claim 1, further comprising:

a first ground connection part to connect an edge of said antenna element to said first ground plane; and

a second ground connection part to connect said edge of said antenna element to said second ground plane, wherein

said feeding part feeds to a feeding point on said antenna element which is not located on said edge.

- (3) The antenna apparatus according to Claim 1, further comprising:

an elastic body part connected to said edge of said antenna element, the shape of which elastic body part is a rectangular parallelepiped having conductive surfaces and a non-conductive interior, and, wherein;

a first surface of the elastic body part contacts said first ground plane and a second surface of the elastic body part contacts said second ground plane.

- (4) The antenna apparatus according to Claim 1, wherein said feeding part comprises;

a core-wire to feed to said antenna element, and;

a shield part, which is connected on a tangent line of said first ground plane and said second ground plane and which shields said core wire from electromagnetic fields.

- (5) The antenna apparatus according to Claim 1, wherein;

a distance between said first ground plane and said antenna element is approximately the same as a distance between said second ground plane and said antenna element.

- (6) The antenna apparatus according to Claim 1, wherein a distance between said first ground plane and said antenna element is equal to or less than one-fourth a wavelength of the electromagnetic waves primarily received and transmitted by said antenna apparatus.

- (7) The antenna apparatus according to Claim 6, wherein;

a distance between said second ground plane and said antenna element is approximately the same as said distance between said first ground plane and said antenna element.

- (8) The antenna apparatus according to Claim 1, wherein
- said first ground plane is approximately perpendicular to said second ground plane.
- (9) The antenna apparatus according to Claim 8, wherein
- said antenna element is provided in a perpendicular direction to said first ground plane from the opposite side of a tangent line in said first ground plane with said second ground plane, and provided in a perpendicular direction to said second ground plane from the opposite side of a tangent line in said second ground plane with said first ground plane.
- (10) The antenna apparatus according to Claim 1, further comprising:
- a transmitting and receiving apparatus for communicating wirelessly and comprising a display panel for displaying information to users, and wherein;
- said antenna element comprises a rod-shaped plane located in said transmitting and receiving apparatus and oriented such that the plane of said antenna element and a side of said display panel are parallel.

(11) A transmitting and receiving apparatus, comprising:

a rod-shaped antenna element;

a feeding part to feed electronic signals to, and receive electronic signals from, said antenna element;

a first ground plane near said antenna element and oriented approximately parallel to said antenna element so as to serve as a background to at least one direction in which said antenna element radiates electromagnetic waves;

a second ground plane near said antenna element and oriented approximately parallel to said antenna element and in a different direction from said first ground plane, and;

a communication part for performing radio communications using electronic signals fed to said antenna element and/or received by said antenna element from an outside source.

(12) The transmitting and receiving apparatus according to Claim 11, further comprising:

a first ground connection part to connect an edge of said antenna element to said first ground plane; and

a second ground connection part to connect said edge of said antenna element to said second ground plane, wherein

said feeding part feeds to a feeding point on said antenna element which is not located on said edge.

- (13) The transmitting and receiving apparatus according to Claim 11, further comprising:

a display panel for displaying information to users; and

a main body part hingedly connected to said display panel such that the main body-display panel assembly may be moved between opened and closed positions and such that said display panel is shielded from the outside when the assembly is in the closed position, wherein;

said antenna element comprises a rod-shaped plane oriented such that a long axis of said antenna element is approximately parallel with a side of said display panel and perpendicular to a shielding plane that shields said display panel in said main body part.

- (14) The transmitting and receiving apparatus according to Claim 11, wherein

said antenna element is provided in a perpendicular direction to said first ground plane from the opposite side of a tangent line in said first ground plane with said second ground plane, and provided in a perpendicular direction to said second ground plane from the opposite side of a tangent line in said second ground plane with said first ground plane.

- (15) The transmitting and receiving apparatus according to Claim 11, wherein said feeding part comprises;

a core-wire to feed to said antenna element, and;

a shield part, which is connected on a tangent line of said first ground plane and said second ground plane and which shields said core wire from electromagnetic fields.

- (16) The transmitting and receiving apparatus according to Claim 11, wherein

a distance between said first ground plane and said antenna element is approximately the same as a distance between said second ground plane and said antenna element.

- (17) The antenna apparatus according to Claim 11, wherein a distance between said first ground plane and said antenna element is equal to or less than one-fourth a wavelength of the electromagnetic waves primarily received and transmitted by said antenna apparatus.

- (18) The antenna apparatus according to Claim 17, wherein;

a distance between said second ground plane and said antenna element is approximately the same as said distance between said first ground plane and said antenna element.

- (19) The transmitting and receiving apparatus according to Claim 11, wherein

said first ground plane is approximately perpendicular to said second ground plane.

- (20) The transmitting and receiving apparatus according to Claim 11, wherein

said antenna element is provided in a perpendicular direction to said first ground plane from the opposite side of a tangent line in said first ground plane with said second ground plane, and provided in a perpendicular direction to said second ground plane from said opposite side of a tangent line in said second ground plane with said first ground plane.